

Astrobee

Space Station Robotic Free Flyer



POIWG #50
July 28, 2016

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Project Summary

- Develop, test, deliver 2 free flying robots for ISS IVA use
- 3 year project (FY15-FY17) under Human Exploration Telerobotics 2 (HET2)
- 1 year (FY18) extension for on-orbit commissioning (proposed)
- Sponsor: Space Technology Mission Directorate, Game Changing Development Program
- Technology infusion to ISS payloads & operations





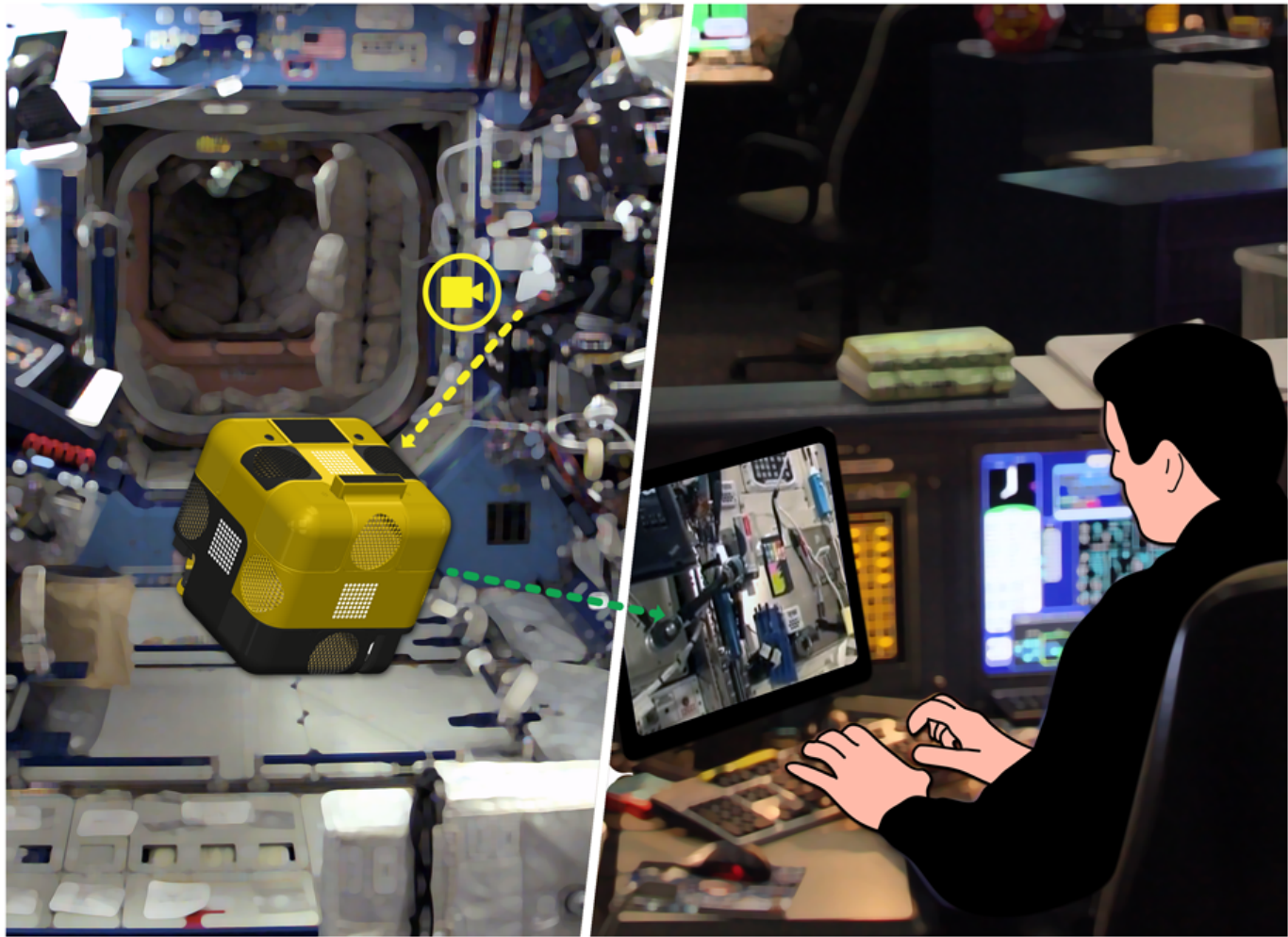
0g Robotics Research Facility



AES, SPHERES Program, SPHERES users



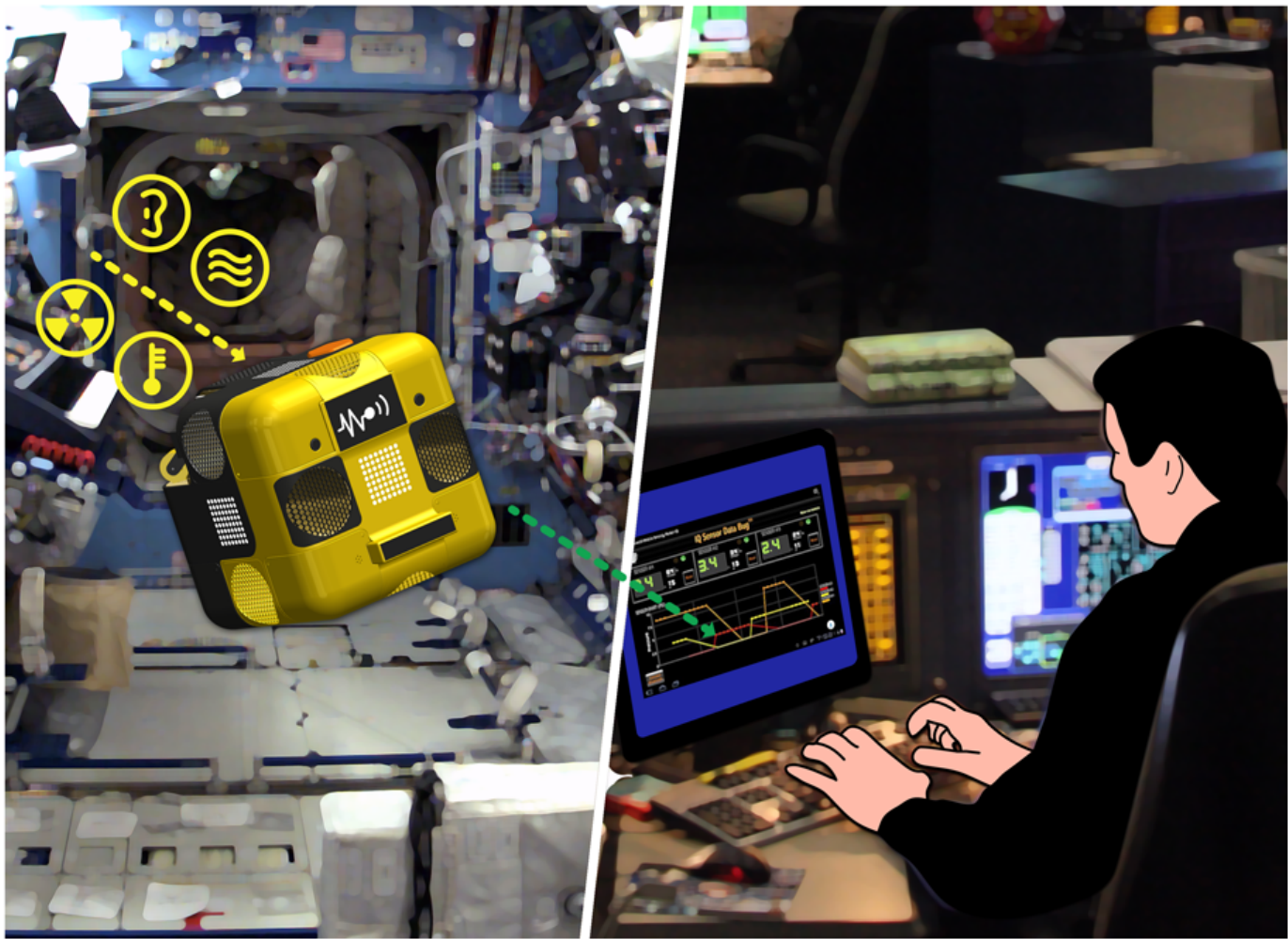
Mobile Camera Tasks



ISS Program, FOD, POIC



Mobile Sensor Tasks



ISS Program, FOD, POIC

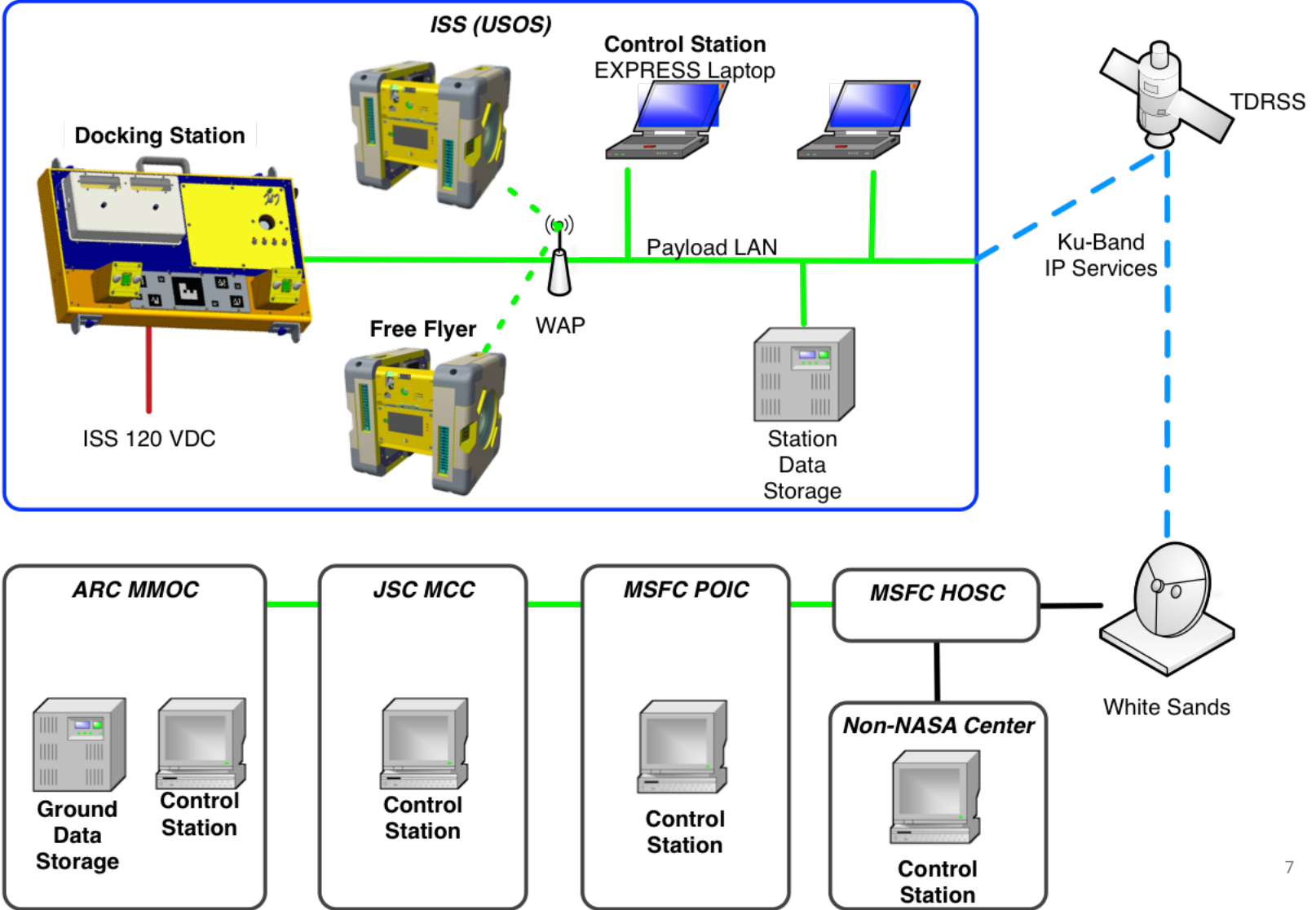


Dock & Resupply





System Architecture

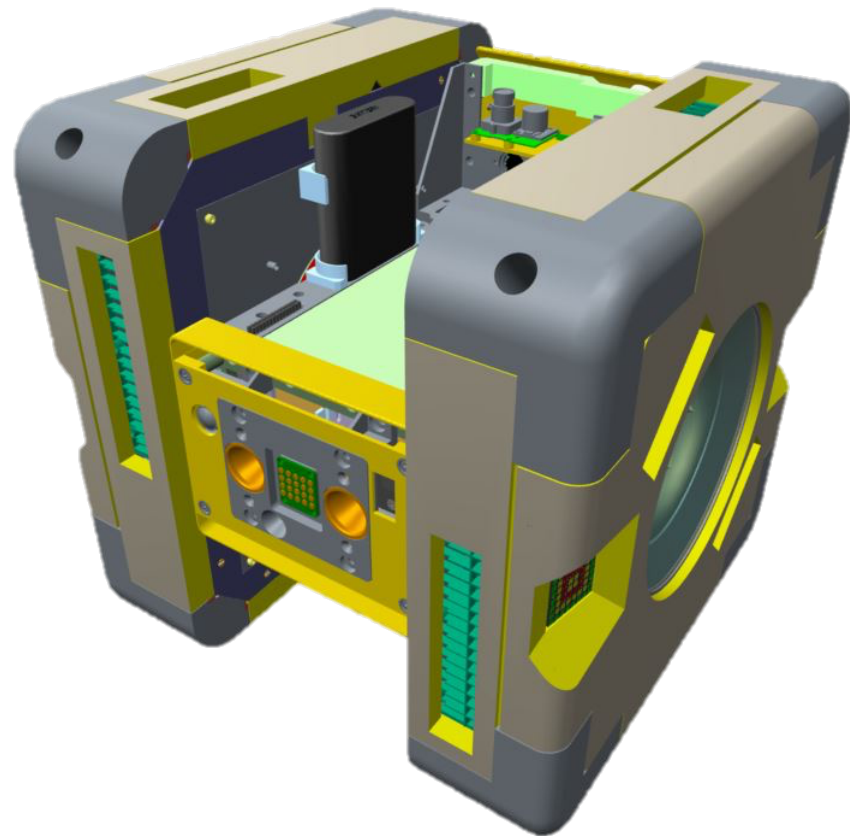




Astrobee Free Flyer



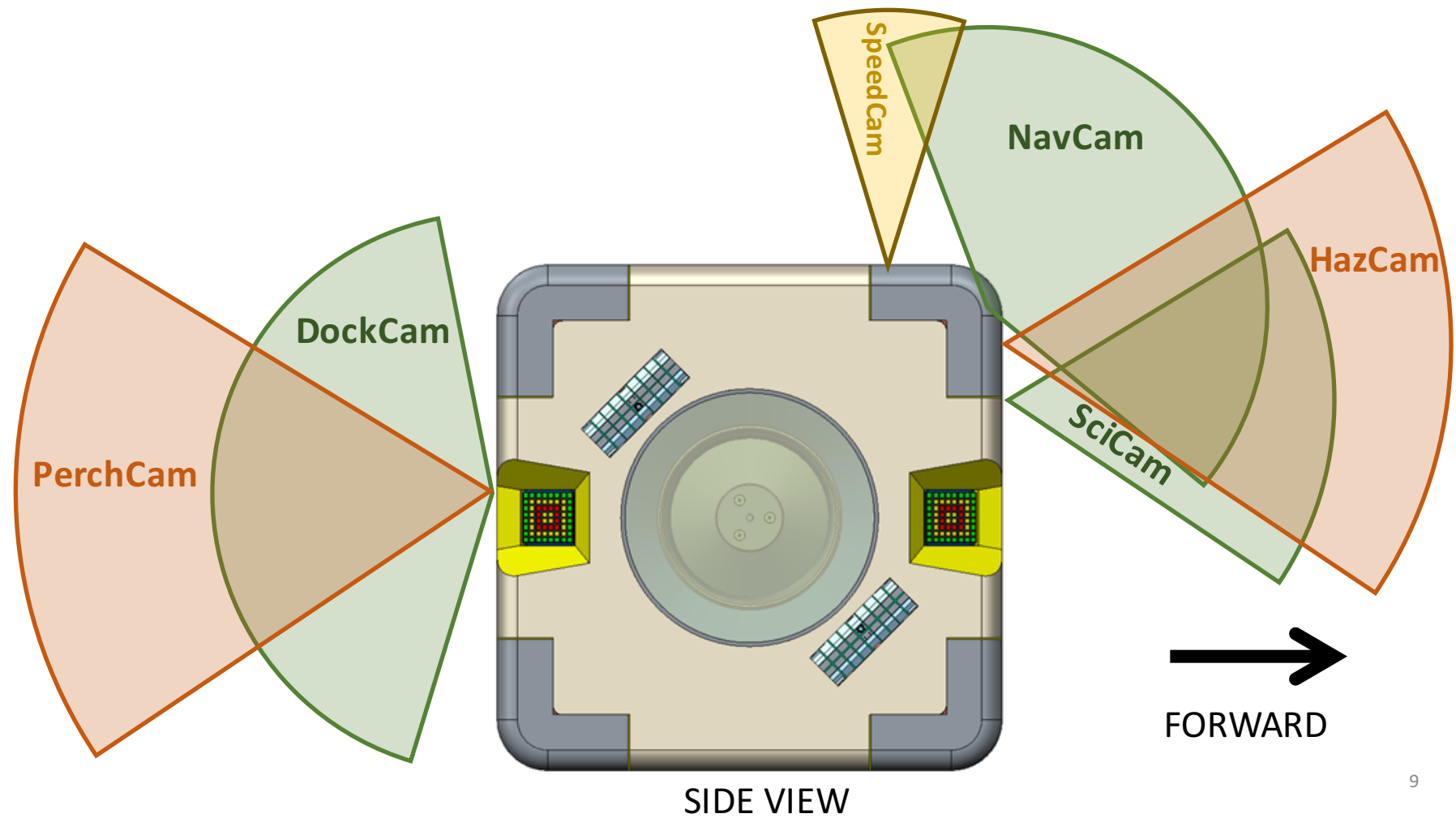
Forward Top



Aft Top

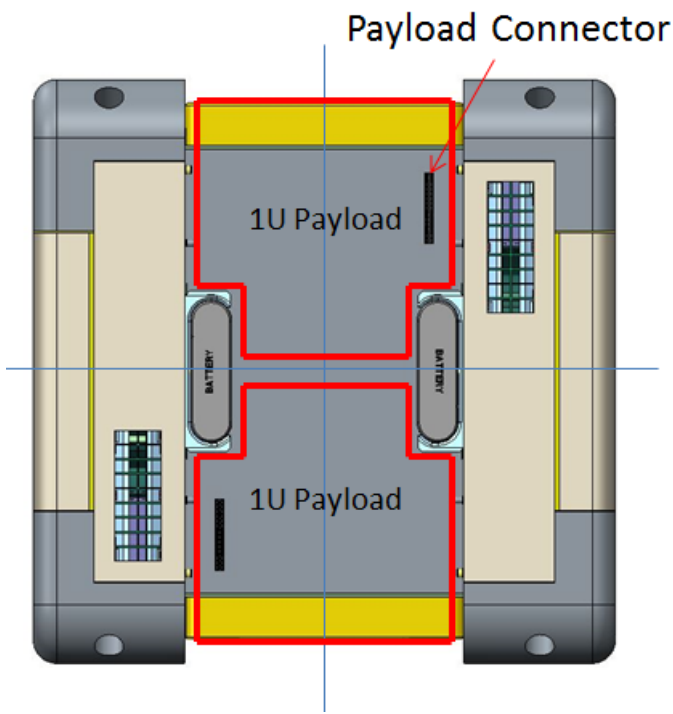


External Sensors

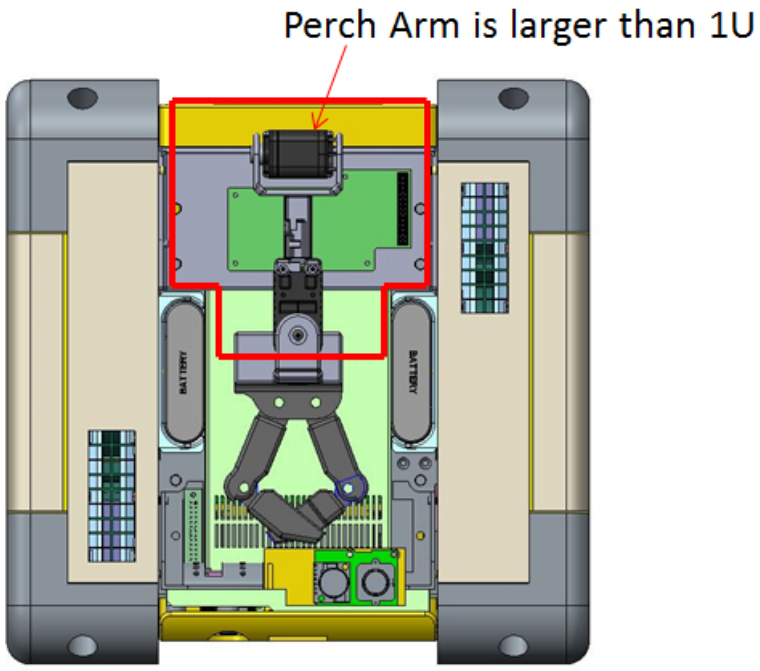




Payload Layout



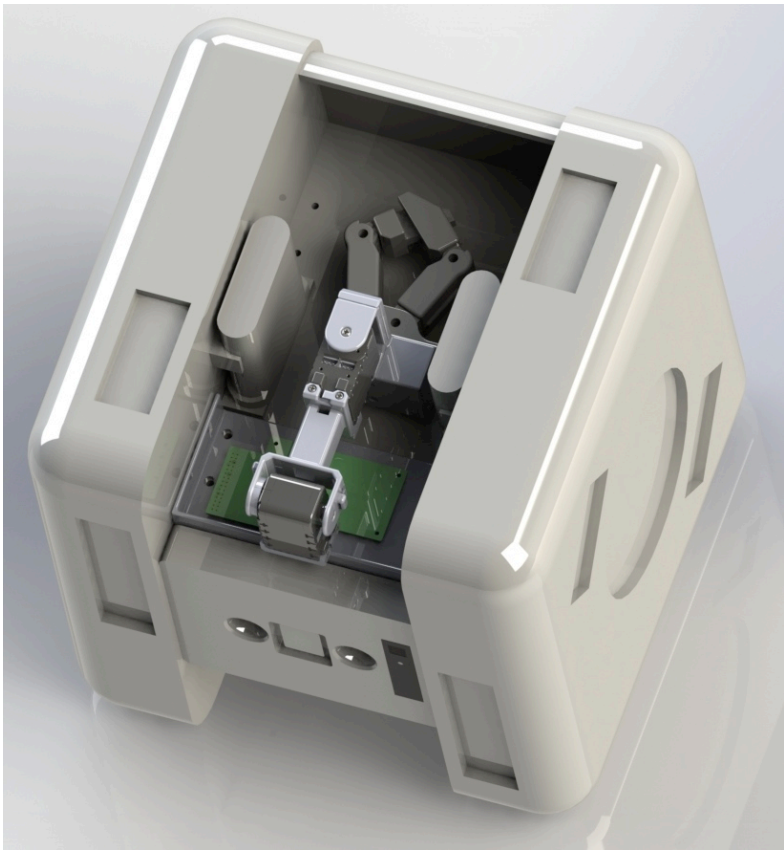
Bottom



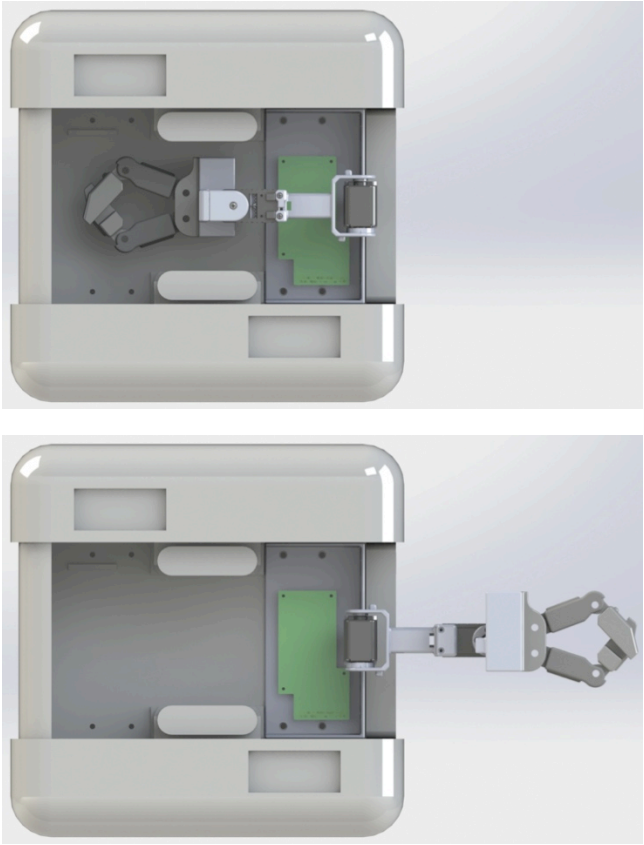
Top



Perching Arm



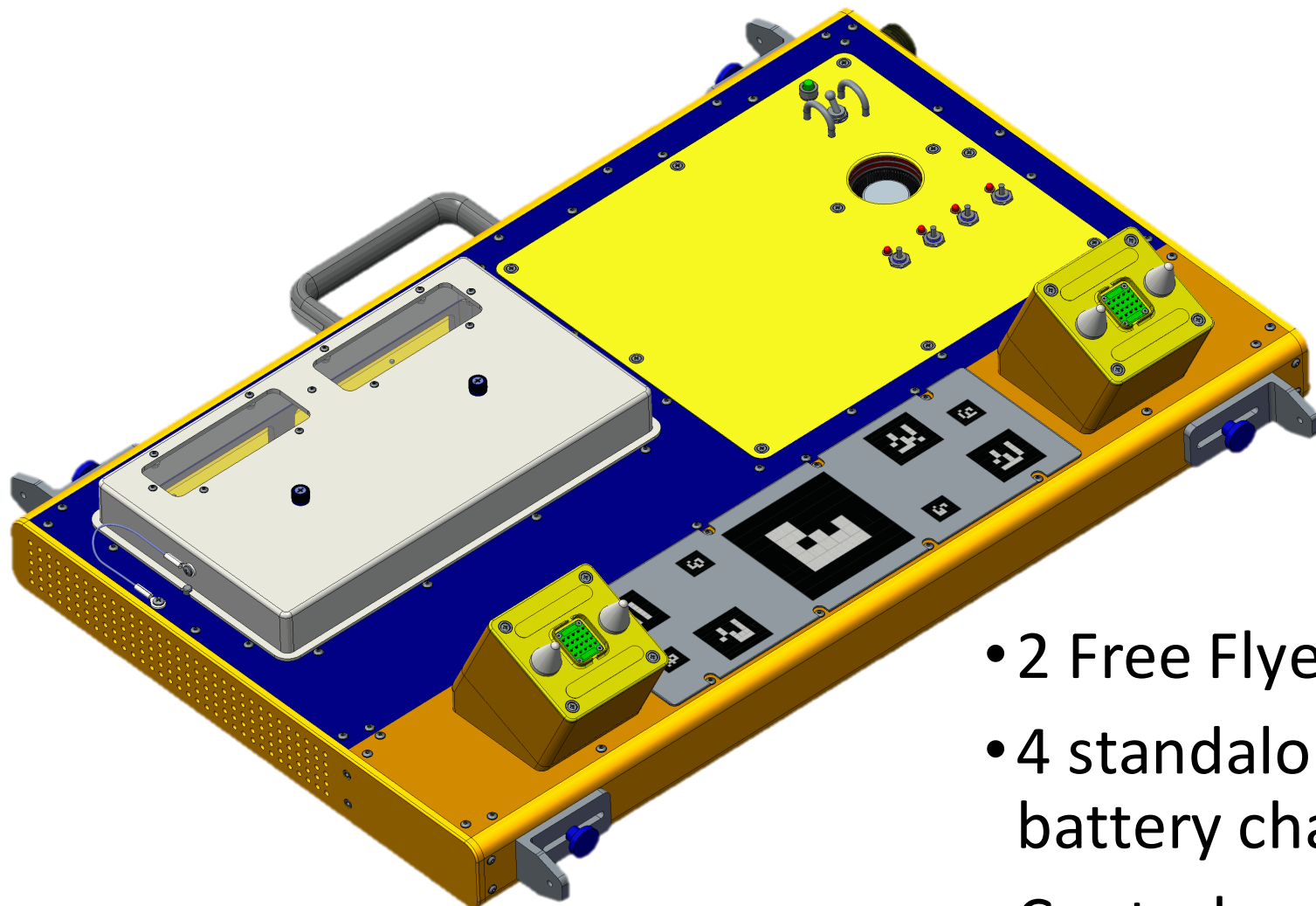
Stowed



Stowed/Deployed



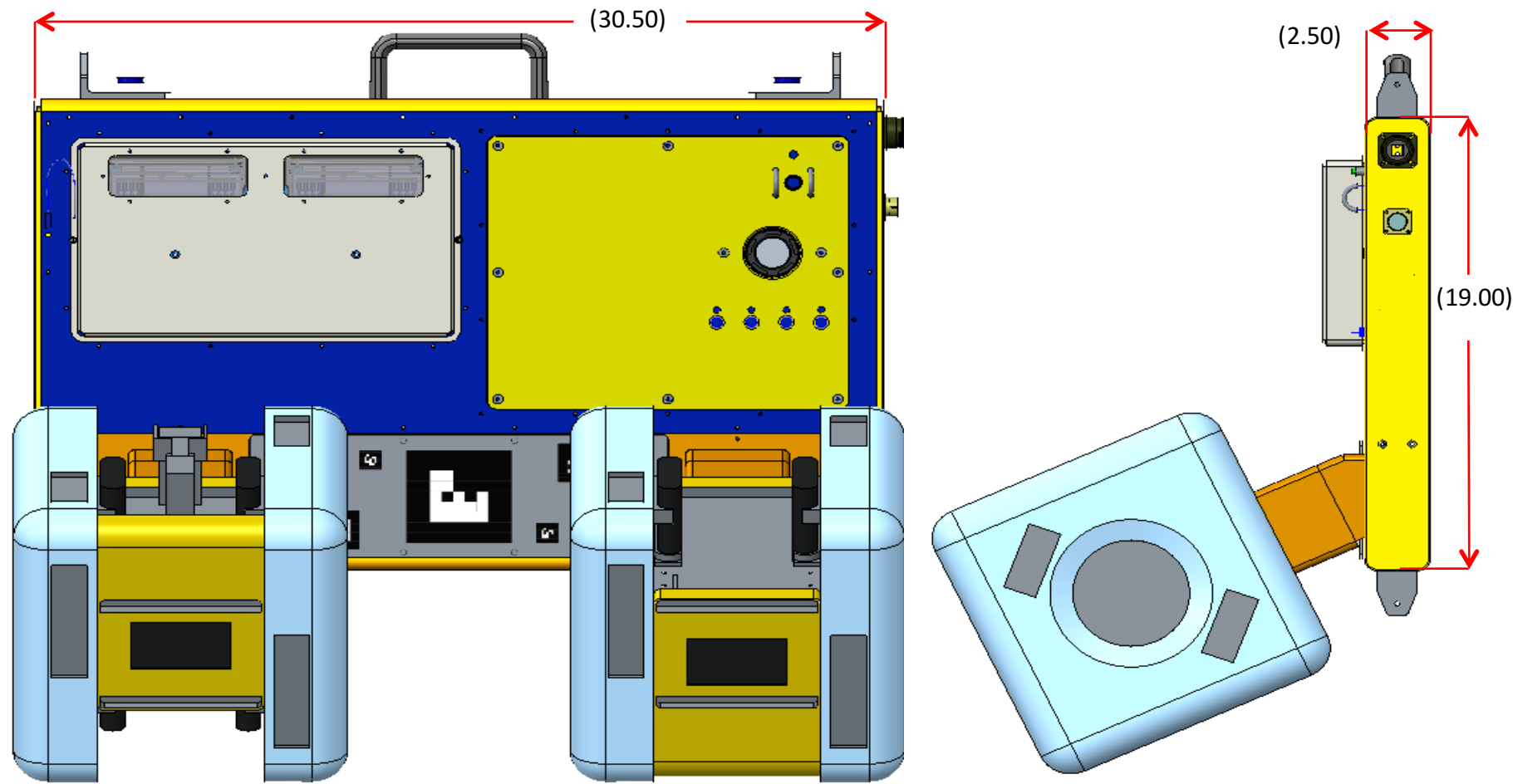
Docking Station



- 2 Free Flyer berths
- 4 standalone battery chargers
- Control panel



Docking Station Front and Side View

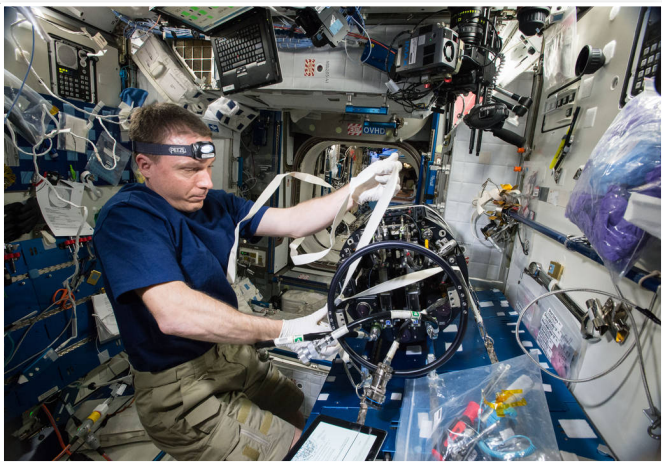


NOTE: Dimensions are in inches

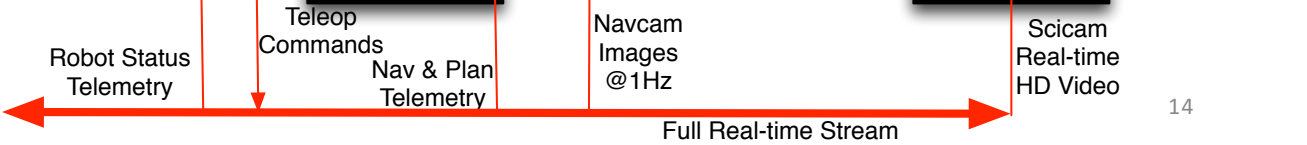
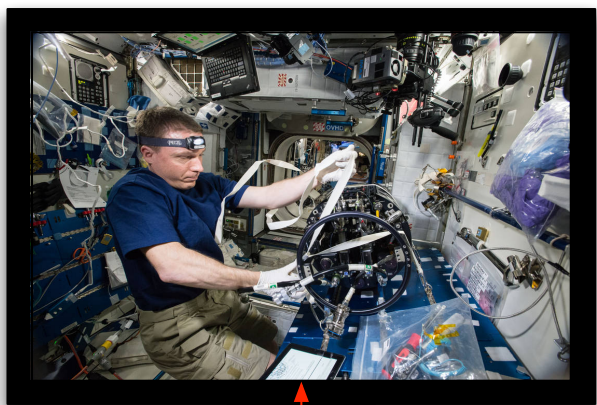
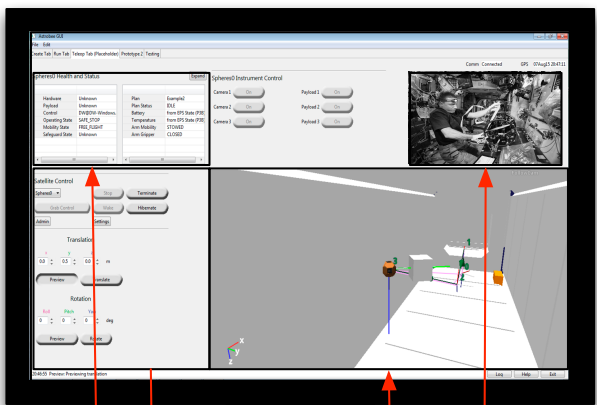


Control Station

- Eclipse based GUI
- Create, run, tele-op plans
- Run guest science
- Administration
- Separate ground UI for file transfer, software updates and diagnostics



Distributed Video





Plan Validation

Plan Editor

Run Plan

Teleoperation

Guest Science

Advanced

Comm

Not Connected

GPS

01Jun16 23:00:39

Plan Editor

Plan Name

AADemo

Estimated Duration

00:11:02

Validation

Not Validated

Validate

Plan Step	Duration
▼ AADemo	
0 Station	
0-1 Segment	00:01:23
1 Station	
1-2 Segment	00:01:44
2 Station	
2-3 Segment	00:01:41
3 Station	
3-4 Segment	00:02:41
4 Station	
4-5 Segment	00:02:20
5 Station	
5-6 Segment	00:01:13
6 Station	

Add

Delete

Add via 3d View

3 Station

Location Based

Coordinate Based

Bookmarks

Commands

X

5.78

Y

-0.19

Z

-0

m

Roll

0

Pitch

0

Yaw

0

deg

☐ Ignore Orientation

Tolerance

0.1

m

☐ Drag to Translate

☐ Drag to Rotate

Interactive Plan Viewer

Reset View

Validation Failed

Potential collision in Segment 2-3. Please move Station 2 or Station 3.

OK

00:00:00 Message goes here

Log

Help

Exit



Run Plan Tab

File Edit View Help

Plan Editor Run Plan Teleoperation

FreeFlyerA Health and Status Fault Details

Hardware	Nominal
Payload	Nominal
Software	Nominal
Control	Dw@dw-windows7-32
Operating State	Plan Execution
Mobility State	Free Flight
Safeguard State	-
Plan	Bb

Plan Step	Duration	Success
BB		
0 Station		Complete
0-1 Segment	00:01:14	Complete
1 Station		Complete
1-2 Segment		
2 Station		
2-3 Segment		
3 Station		
3-4 Segment		

Comm Connected GPS 16Mav16 19:19:24

rapid_imagesensor_sample-science

Image #164

Commands for: FreeFlyerA

Grab Control Terminate

Wake Hibernate

Plan Name Plan Valid

File ... C:\Users\DW\Document Upload

Run Stop

Pause Skip Step

Live Telemetry

Reset View



Teleoperation Tab

File Edit View Modeling Help

Plan Editor Run Plan Teleoperation

FreeFlyerA

Health and Status

Fault Details

Hardware	Nominal
Payload	Nominal
Software	Nominal
Control	Dw@dw-windows7-32
Operating State	Safe Stop
Mobility State	Docked
Safeguard State	-
Plan	-

Instrument Control for: FreeFlyerA

Comm Connected GPS 22Apr16 20:30:52

Info Label

Camera 1 On

Payload 1 On

Camera 2 On

Payload 2 On

Camera 3 On

Payload 3 On

Commands for: FreeFlyerA

Grab Control

Terminate

Wake

Hibernate

Stop

Undock

Translation

Rotation

Arm Commands

AFT 1.0 FWD

PORT 0.0 STBD

OVHD 0.0 DECK

m

Reset Preview

Show Preview

Translate

Teleop Command Log

20:30:11 FreeFlyerA: Completed

Live Telemetry

Reset View

17

Log

Help

Exit

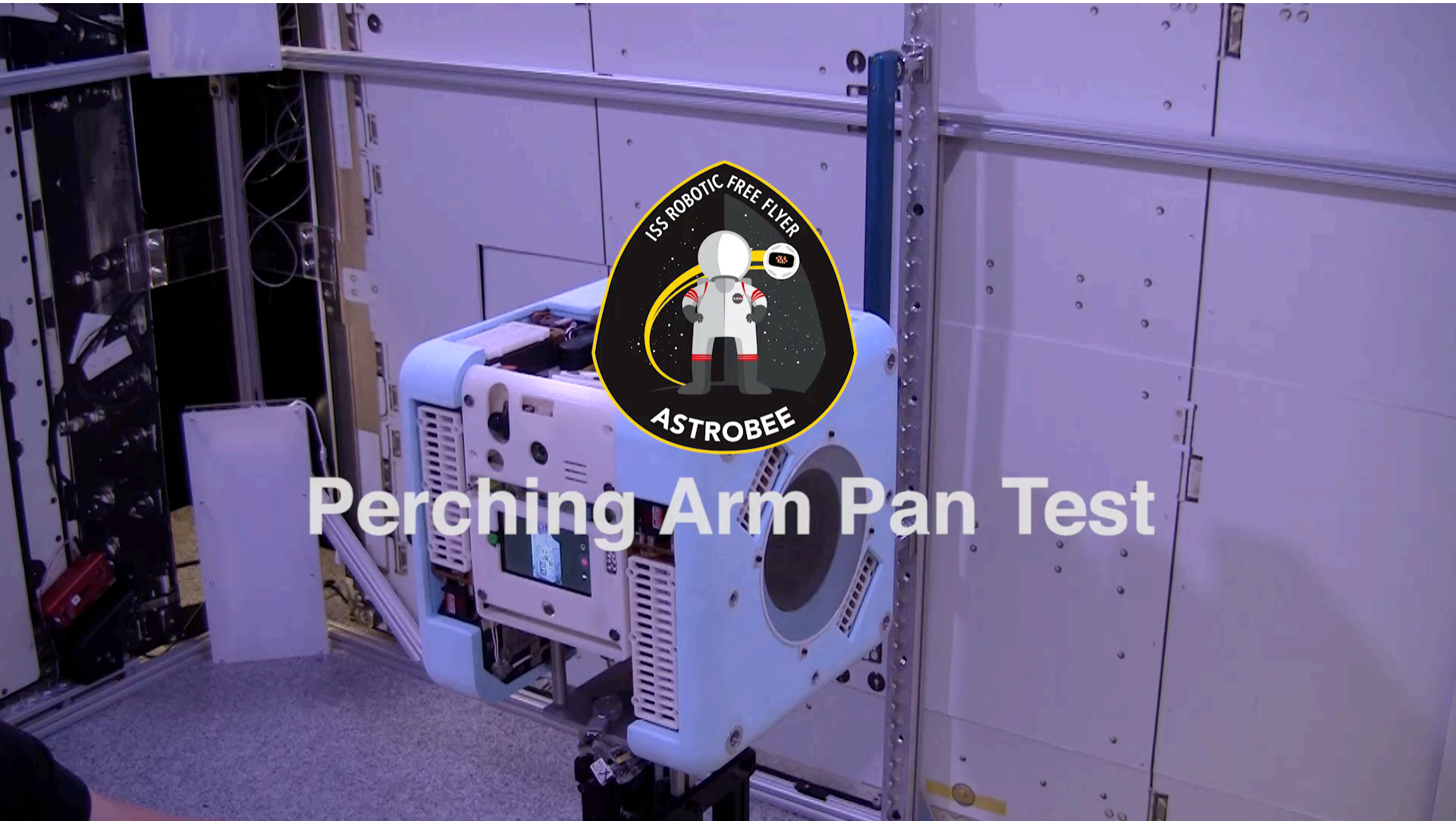


Navigation Demonstration





Perching Arm Demonstration



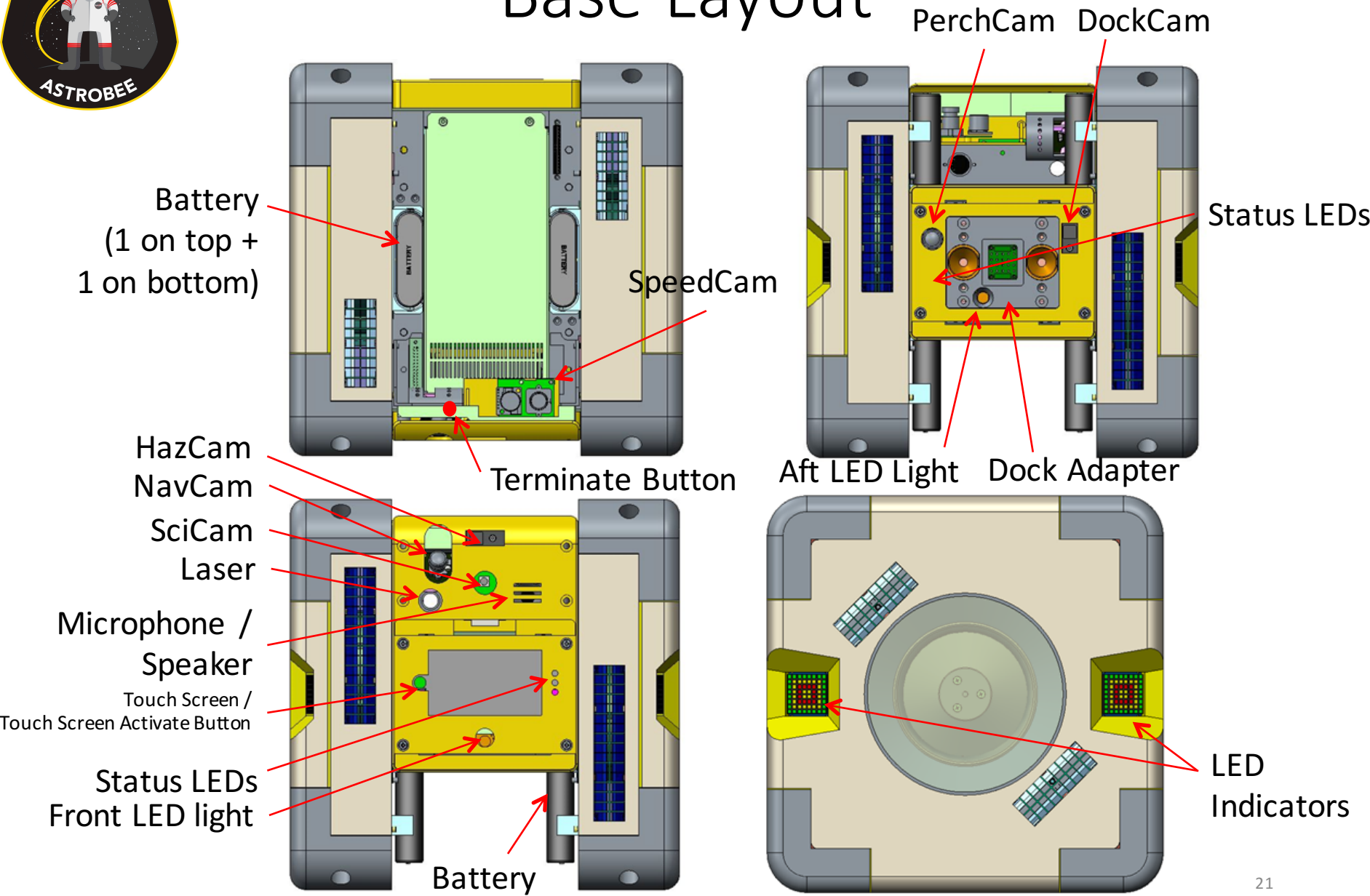
Perching Arm Pan Test



Backup



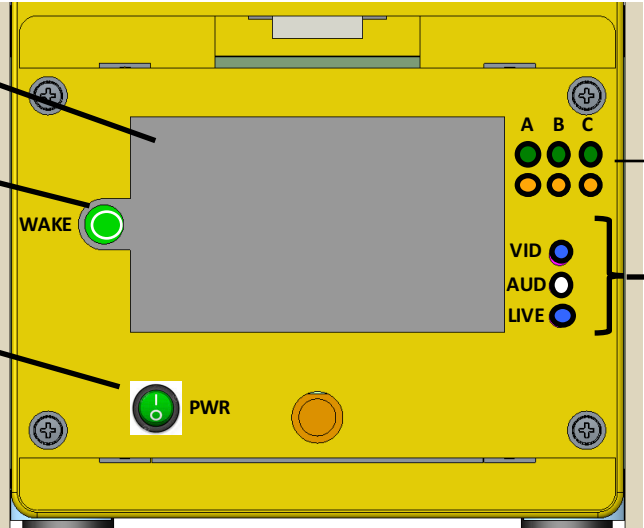
Base Layout



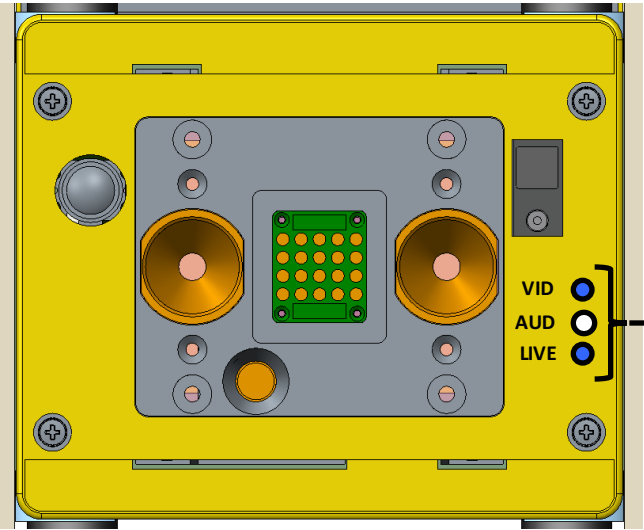


Indicators

- Touch Screen Activate Button
- Wake Button (illuminated green when awake)
- Power Switch (illuminated green when power is on)



- General Status LEDs (crew can call down status in case of errors, like "A is green, B is amber, C is off")
- A/V Mode LEDs (blue, white, blue)



- A/V Mode LEDs (blue, white, blue)